Run-time anomaly detection and mitigation in information-rich cyber-physical systems

Completed Technology Project (2016 - 2019)

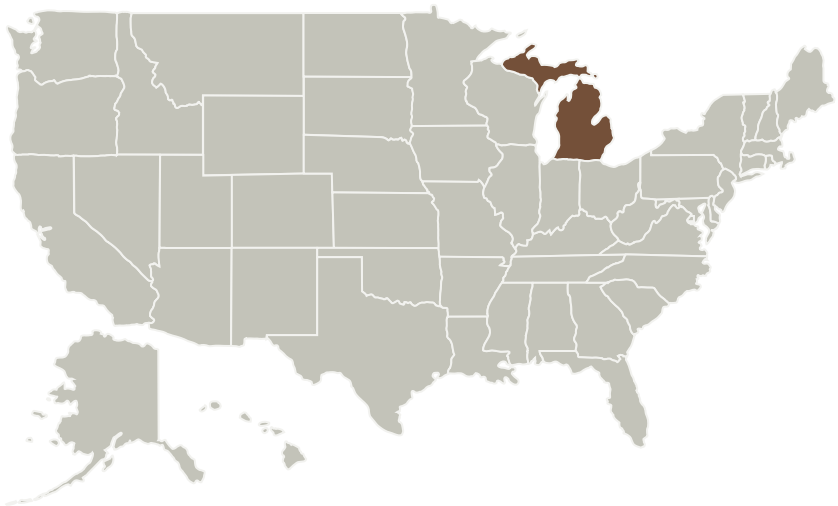
Project Introduction

Next generation space missions require autonomous systems to operate without human intervention for long periods of times in highly dynamic environments. Such systems are vulnerable to software and/or hardware failures due to unexpected internal or external factors. Moreover, small anomalies, if not detected and isolated in a timely manner, can cascade through the system resulting in catastrophic outcomes, especially in highly dynamic missions where fail safe is not an option. This signifies the need for effective methods for integrated system health management, automated data analysis for decision making and verification and validation. The objective of this project is to develop the scientific foundation and associated algorithmic tools for synthesis of decentralized passive and active monitors for provably correct run-time verification and validation of sensor-rich networked cyber-physical systems. The potential benefits of the proposed research include (i) reductions in the design time of next generation space systems by automating synthesis of monitoring algorithms instead of hand-coded built-in tests, (ii) reductions in system cost by the potential to replace hardware redundancy with software-based solutions, (iii) increase in the time systems operate reliably by enabling timely detection of anomalies and reducing their cascading effects.

Anticipated Benefits

The potential benefits of the proposed research include reductions in the design time of next generation space, reductions in system cost, and increase in the time systems operate reliably.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
University of Michigan-Ann Arbor	Lead Organization	Academia	Ann Arbor, Michigan

Primary U.S. Work Locations
Michigan

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Michigan-Ann Arbor

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

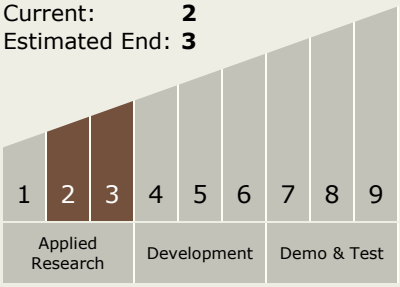
Hung D Nguyen

Principal Investigator:

Necmiye Ozay

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



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Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.1 Situational and Self Awareness
    - TX10.1.6 Anomaly Detection

Target Destination

Foundational Knowledge